



CLAY CAVES

SUBJECTS: Science

GRADES: K-2

KERA GOALS: Meets KERA goals 4, 5, and 6

ACADEMIC EXPECTATIONS: Becoming a productive group member; consistent, responsive, and caring behavior; rights and responsibility of self and others; conceptualizing; critical thinking; developing new knowledge; and expanding existing knowledge

DURATION: One 25-40 minute period

GROUP SIZE: One classroom of 25-35 students (or less)

SETTING: Indoors or Outdoors

KEY VOCABULARY: sandstone, limestone, water, time, ocean, shells, dissolved

ANTICIPATORY SET: Today we are going to make caves. Our caves will be models of limestone caves, like the ones found at Mammoth Cave National Park. Does anyone know what special ingredients it takes to make a cave in this area?

OBJECTIVES: The students will be able to: 1) work productively in small groups to make a cave; 2) conceptualize how water carves or creates Mammoth Cave

MATERIALS:

- ◆ Modeling clay (4 oz. per student or group)
- ◆ Sugar cubes (3-6 per cave)
- ◆ Warm water
- ◆ See-through bowls (1 per student or group)
- ◆ Copies of Clay Caves Activity Sheet

BACKGROUND: The two basic rocks found in the Mammoth Cave area are limestone and sandstone. Limestone is the “soft” rock (more water soluble) that is dissolved more easily by water. Sandstone and shale are the rocks that are on top of the cave. They are “harder” (less water soluble) and don’t let the water soak into the cave.

The limestone was laid down in this part of Kentucky around 270-350 million years ago. At that time Kentucky was further south, close to the equator. A shallow, warm inland sea covered the land. As the animals that lived in that sea died, their hard bodies (shells) fell to the bottom of the ocean. With time and pressure the shells compacted together to form limestone. The limestone in this area is between 700-1200 feet thick. After many years of deposition the sea receded, as the continent slowly drifted north.

The next major geological period to affect the Mammoth Cave area was a glacial period. Glaciers were found to the north of Kentucky. These large glaciers began to melt and formed rivers, which flowed south. This part of Kentucky became the river’s delta. The river left behind additional sand, silt, and sediment it carried with it. This sand and silt became our caprock or the layers of sandstone and shale.

Mammoth Cave was formed when water seeping through cracks in the sandstone formed underground rivers. These rivers eventually carved large cave passageways in the limestone. It has taken a lot of water and a lot of time to create Mammoth Cave.



CLAY CAVES

PROCEDURE:

1. The teacher asks the students what it takes to make a cave. The teacher writes the student's answers on the blackboard (rocks, water, time, etc.).
2. The teacher then explains that there are two types of rock that make up Mammoth Cave. The one that is softer and easily dissolved by water is called limestone. The second is harder and is on top of the limestone. Since it is harder it is a good roof to Mammoth Cave, protecting it. This harder rock is sandstone and shale. It takes a lot longer for water to dissolve this sandstone caprock.
3. The teacher passes out a lump of clay to each student (or each group of students, approximately 4 oz.) The clay will be the sandstone in our model. The teacher also passes out 3 or 6 sugar cubes, to make different sized caves. The sugar cubes will be the softer limestone in our model.
4. The students flatten their clay out into a "pancake." Then they should place the sugar cubes on the clay, so that each cube touches the other, and with at least one cube touching the edge of the clay. Then the students wrap the clay around the sugar cubes, forming a ball. The students need to make sure that at least one sugar cube is exposed. (See attached "Making of the Caves" instruction sheet.)
5. "Now that we have our rock layers, what do we need to turn it into a cave?" The students should respond, "water." Each student or group should have a small see-through bowl, (cutting the top off 2 liter bottles works well). Instruct the students to put their cave in the water. The students should observe what happens.
6. The students may observe: 1) That nothing is happening. 2) The cave may bubble for a minute or so until the sugar starts to dissolve. (This reinforces the idea that it takes some time for a cave to form.) 3) The sugar will begin to dissolve leaving a hole behind. The students can remove their cave from the water and look at it.
7. The class groups back together and notes their observations on the board. The teacher asks the

students to fill out their Clay Cave activity sheet.

CLOSURE: We have made models of a limestone cave. For natural places like caves to form we know it takes a long time and the right ingredients. That is why we need to take care of our special natural places.

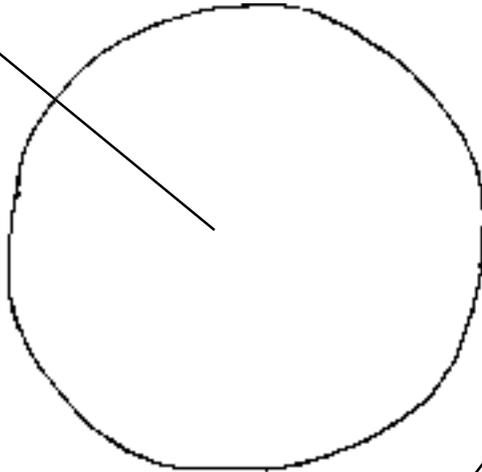
EVALUATION: The teacher is able to evaluate the students during their class discussion and by reading over their activity sheets.

EXTENSIONS:

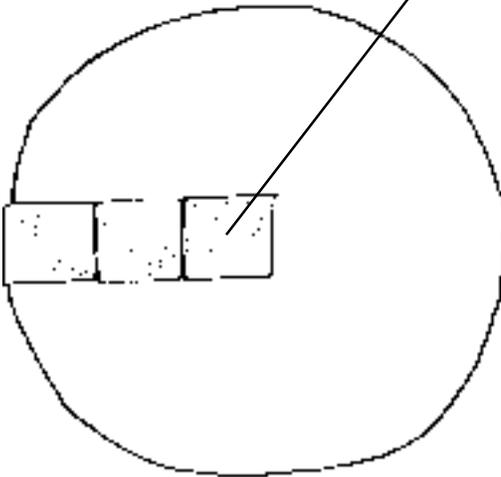
1. A follow-up activity could be to make rock candy and talk about how that relates to the formations found inside the cave.
2. The class may want to visit a cave within the Mammoth Cave region to identify the differences between the sandstone and limestone while being in the field.
3. The students could find other items that would dissolve in water, that could act as models for the limestone, and other items that do not dissolve that could be models for the sandstone.

MAKING THE CAVES

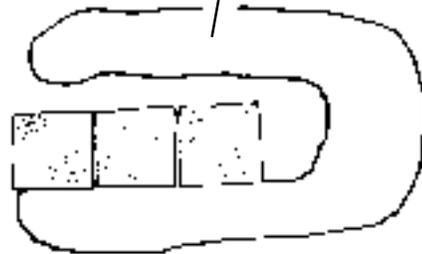
1. Flatten the clay into a pancake shape.



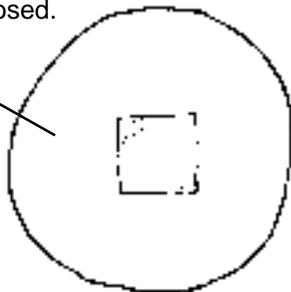
2. Place the sugar cubes on the clay, all touching each other. Make certain that at least one cube is at the edge of the clay.



3. Wrap the clay around the sugar cubes...



4. ...forming a ball. Make certain that at least one sugar cube is exposed.



5. When the ball of clay is placed in the water, the sugar will dissolve, leaving a "limestone cave" behind.



CLAY CAVES

Fill in the blanks by using these words:

LIMESTONE
DISSOLVE
TIME
SANDSTONE
WATER

1. The clay in our model is

rock.

2. The sugar cubes in our

model are _____

rock.

3. It takes _____

and _____ to

make a cave.

4. Limestone is the softer rock

that can _____.

Observations

1. What do you see happening right away?

2. What happens next?

3. What do you have left in the end?